10:11:01 OCA PAD INITIATION - PROJECT HEADER INFORMATION 10/27/87

Active

Project #: G-41-666 Cost share #: NA Rev #: 0
Center # : R6405-0A0 Center shr #: OCA file #:
Work type : RES
Contract#: AGR DTD 870821 Mod #: Document : GRANT
Prime #: DE-FG06-87ER13660 Contract entity: GTRC

Subprojects ? : N
Main project #:

Project unit: PHYSICS Unit code: 02.010.152
Project director(s):
GRAFF M M PHYSICS

Sponsor/division names: UNIVERSITY OF OREGON / EUGENE, OREGON
Sponsor/division codes: 400 / 072

Award period: 870817 to 880114 (performance) 880314 (reports)

Sponsor amount	New this change	Total to date
Contract value	25,684.00	25,684.00
Funded	25,684.00	25,684.00
Cost sharing amount		0.00

Does subcontracting plan apply ?: N

Title: REACTIVE COLLISIONS OF HIGH-TEMPERATURE SYSTEMS

PROJECT ADMINISTRATION DATA

OCA contact: Earnestine P. Smith 894-4820

Sponsor technical contact

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EUGENE, OR 97403-0237

Sponsor issuing office

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Security class (U,C,S,TS) : U ONR resident rep. is ACO (Y/N): N
Defense priority rating : NA NA supplemental sheet
Equipment title vests with: Sponsor GIT X
DOE RESERVES THE RIGHT TO TRANSFER OWNERSHIP TO THIRD PARTIES.

Administrative comments -
SUBCONTRACTS AND CONSULTING AGREEMENTS REQUIRE SPONSOR APPROVAL. PREAWARD COSTS AUTHORIZED FROM 8/17/87. PERFORMANCE PERIOD IS 9/1/87-1/14/88.

SPONSORED PROJECT TERMINATION/CLOSEOUT SHEET

Date 2/1/88

Project No. G-41-666 School/Lab Physics

Includes Subproject No.(s) N/A

Project Director(s) M. M. Graff GTRC/GIT

Sponsor University of Oregon

Title Reactive Collisions of High-Temperature Systems

Effective Completion Date: 1/14/88 (Performance) 3/14/88 (Reports)

Grant/Contract Closeout Actions Remaining: Final submitted early.

- [ ] None
- [x] Final Invoice or Copy of Last Invoice Serving as Final
- [x] Release and Assignment
- [x] Final Report of Inventions and/or Subcontract:
  Patent and Subcontract Questionnaire sent to Project Director [x]
- [x] Govt. Property Inventory & Related Certificate
- [ ] Classified Material Certificate
- [ ] Other _____

Continues Project No. _____ Continued by Project No. _____

COPIES TO:

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GTRC
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Other _____

Margaret M. Graff
University of Oregon/Georgia Institute of Technology
Project DE-FG06-87ER13660
"Reactive Collisions of High-Temperature Systems"

Report of technical progress, 1987 funding year (Final report)

The grant was initiated on 15 January 1987. The experiment being developed under the current project involves the reactive collision of a low-energy mass- and velocity-selected beam of neutral radicals (e.g. O) with a stable reactant (e.g. H_2) in a temperature-controlled cell. During the initial phase we have been developing the capabilities of the experiment to study ion-neutral reactions so that its performance may be tested against similar systems (e.g. the well-studied $C^+ + H_2$) in other laboratories. The major stages of the experiment this year have been

- assembly of vacuum system and internal components,
- purchasing of much necessary equipment,
- development and testing of ion beam and beam diagnostics,
- testing of the temperature-controlled reaction cell,
- construction of parahydrogen synthesis system, and
- construction of ion detection system.

These activities are described in detail below.

The basic (external) vacuum system was essentially complete at the beginning of the grant period. The purchase of ion gauges and gauge controllers allowed us to pump down and complete vacuum diagnostics. The present vacuum system's performance exceeds our expectations. A larger pump stack has been purchased (not yet installed) for further improvement of the vacuum in reaction cell and ionization/detection regions. The pumping speed is increased further using cryopumping in the ionization region: the ionizer has been surrounded with a reservoir of liquid nitrogen. The liquid nitrogen-cooled reaction cell also provides significant cryopumping.

Internal components of the vacuum system that have been installed and debugged during the funding year include the ion source, ion optics, a Wien mass (velocity) filter, decelerator, energy analysis grids, current diagnostic flags, quadrupole mass filter, and channeltron

electron multiplier. Most of these items were machined or assembled locally.

The electron-impact ion source was constructed and tested following the purchase of necessary power supplies. Following several modifications, we have a basic source design that we believe will provide adequate current with a low translational energy spread. Beams of O^- and O^+ have been achieved. Diagnostic tests of the source, velocity filter, and ion optics continue. Further design modifications design will be made as we optimize current through the reaction cell.

Development of the reaction cell is nearly complete. A diaphragm pressure transducer/readout has been installed for pressure measurement within the cell, and pressure will be maintained constant by a flow controller. A liquid nitrogen automatic fill system has been installed for cell cooling. The reaction cell will contain cold para- or normal hydrogen, and a system for synthesizing parahydrogen has been designed and constructed. The design allows small amounts of para-H_2 to be distilled in liquid helium storage dewars, which are available for use in neighboring laboratories. This eliminates the need for a liquid helium cryostat/handling system. The parahydrogen system is ready for final test and use.

All vacuum components of the detection system (ionizer/quadrupole mass filter/channeltron electron multiplier) have been purchased or constructed. The quadrupole mass filter and support system was machined at University of Oregon. Electronics for signal detection and analysis have been purchased. The detection system for ion-molecule studies has been installed and will be tested in the near future. Neutral studies require installation of an ionizer, which has been assembled from component parts in a modified Weiss design.

Two graduate students worked on the project during winter and spring at University of Oregon; during the summer one graduate and one undergraduate student worked in the laboratory.

In August the principal investigator moved, together with all equipment, to the School of Physics at Georgia Institute of Technology. Reassembly of the apparatus is nearly complete. Several equipment

items that had been borrowed or were available for borrowing from other groups at the University of Oregon (particularly a quadrupole mass filter power supply and an argon ion laser) are being purchased for dedicated use with startup funds from Georgia Tech. In both cases, the items to be purchased are much newer and more powerful than those that had been available on loan at Oregon.

Currently one graduate student is working on the experiment at Georgia Tech. Two or three more students are expected to begin working in the group during September.

The research environment at Georgia Institute of Technology is highly favorable to conducting this research. The School of Physics has a strong commitment to chemical physics: currently two theoretical and one other experimental chemical physicists are on the faculty, and other additions are envisaged for the near future.